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(71) Applicant *(for all designated States except US)*: NOVELTECH SOLUTIONS LTD [FI/FI]; Kyypellontie 1, FIN-21350 Ilmarinen (FI).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: KAUPPINEN, Jyrki [FI/FI]; Kyypellontie 1, FIN-21350 Ilmarinen (FI).

(74) Agent: TURUN PATENTTITOIMISTO OY; P.O. Box 99, FIN-20521 Turku (FI).

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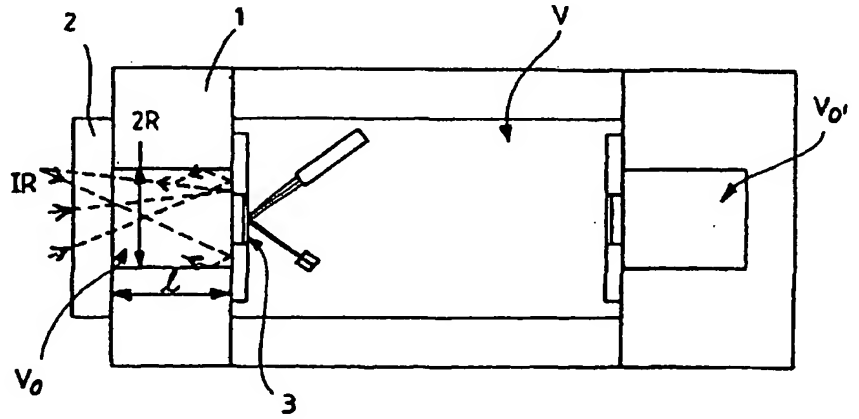
[Continued on next page]

(54) Title: PHOTOACOUSTIC DETECTOR



(57) Abstract: The invention relates to a photoacoustic detector, comprising at least a first chamber (V_0) suppliable with a gas to be analyzed, a window for letting modulated and/or pulsed infrared radiation and/or light in the first chamber (V_0), a second chamber (V), which constitutes a measuring space with a volume *V* and which is in communication with the first chamber by way of an aperture provided in a wall of the first chamber, at least one sensor, which is arranged in the wall aperture of the first chamber and arranged to be movable in response to pressure variations produced in the first chamber by absorbed infrared radiation and/or light, and means for measuring the sensor movement. The means for measuring the sensor movement include at least one or more light sources for illuminating the sensor or a part thereof and one or more multi-detector detectors for the reception of light reflected from the sensor and for measuring the sensor movement as optical angular and/or translatory measurement. The invention relates additionally to a measuring system in a photoacoustic detector, a method for measuring the movement of a sensor in a photoacoustic detector, and a method in the optimization of a photoacoustic detector.

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ARIPO utility model (ZW), ARIPO patent (ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 2003/000683

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01N 21/37, G01J 5/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01N, G01J, H04R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1239698 A1 (KABUSHIKI KAISHA KENWOOD), 11 Sept 2002 (11.09.2002), [0048]; [0049], abstract	1-4,9,11
Y		5-8
	--	
X	US 6210331 B1 (RAZ, R), 3 April 2001 (03.04.2001), column 5, line 15 - line 58	10
Y		5-8
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 February 2004	10 -02- 2004
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Anna Lundqvist /LR Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 2003/000683

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	de Paula, M H et al:. "High-Sensitivity optical microphone for photoacous tics". Rev.Sci.Instrum.63(6),June 1992 1992 American Institute of Physics See the whole document	1-4,9,11
X	de Paula, M H et al: "Optical microphone for photoacoustic spectroscopy". J.Appl.Phys.64(7),1 October 1988 1988 American Institute of Physics See the whole document	1-4,9-11
P,X	US 2003173507 A1 (PARITSKY, A ET AL), 18 Sept 2003 (18.09.2003), see [0001] and abstract	1-4,9,11
A	US 4507170 A (MYHRE, K E), 26 March 1985 (26.03.1985), see the whole document	12,13
A	US 5822061 A (DELHAYE, M ET AL), 13 October 1998 (13.10.1998), see the whole document	12,13

INTERNATIONAL SEARCH REPORT

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see extra sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

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The present application relates to 2 different inventions. The separate inventions are:

Invention 1: Claims 1-11 relate to a photo acoustic detector including a membrane, movable in response to the movement of the gas investigated. The movement of the membrane is measured in an optical way, illuminating the membrane with a light beam and detecting the reflected light.

Invention 2: Claims 12-13 relate to a method for optimizing the amplitude of the membrane movement applying a certain optimization equation.

The special technical feature of invention 1 is to provide a contactless measurement of the membrane movement as optical angular and/or translatory measurement.

The special technical feature of invention 2 is to provide an optimized membrane in a sensor for a photo acoustic detector.

The single general concept of the present application is the contactless measurement of a membrane movement using optical means.

However, this concept is well-known from the prior art since EP1239698 discloses an optical acoustoelectric transducer. The transducer includes a device radiating light toward a vibrating board at a predetermined angle from the light-emitting device and detection means to detect the reflected light. The angle of the reflected light is changed by vibration of the vibrating board due to reception of a sound wave. The vibration displacement of the vibrating board can be detected by detecting the change of a received light. Also what is mentioned in references [2] and [3], disclosed in the application contains information of optical microphones.

Since the concept is known, it cannot be inventive. Hence, there is no single general inventive concept in the sense of Rule 13.1 PCT.

No other features can be distinguished which can be considered as same or corresponding special technical features in the sense of Rule 13.2 PCT.

Thus, the application lacks unity of invention.

INTERNATIONAL SEARCH REPORT

Information on patent family members

24/12/2003

International application No.
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EP	1239698	A1	11/09/2002	DE	1239698	T	10/04/2003
				CN	1433663	T	30/07/2003
				JP	2001169395	A	22/06/2001
				US	2003002129	A	02/01/2003
				WO	0143494	A	14/06/2001
				JP	2001169396	A	22/06/2001
				JP	2001231100	A	24/08/2001
				JP	2001292498	A	19/10/2001
US	6210331	B1	03/04/2001	AU	6184196	A	14/01/1998
				WO	9750003	A	31/12/1997
US	2003173507	A1	18/09/2003	NONE			
US	4507170	A	26/03/1985	US	4376929	A	15/03/1983
US	5822061	A	13/10/1998	NONE			